

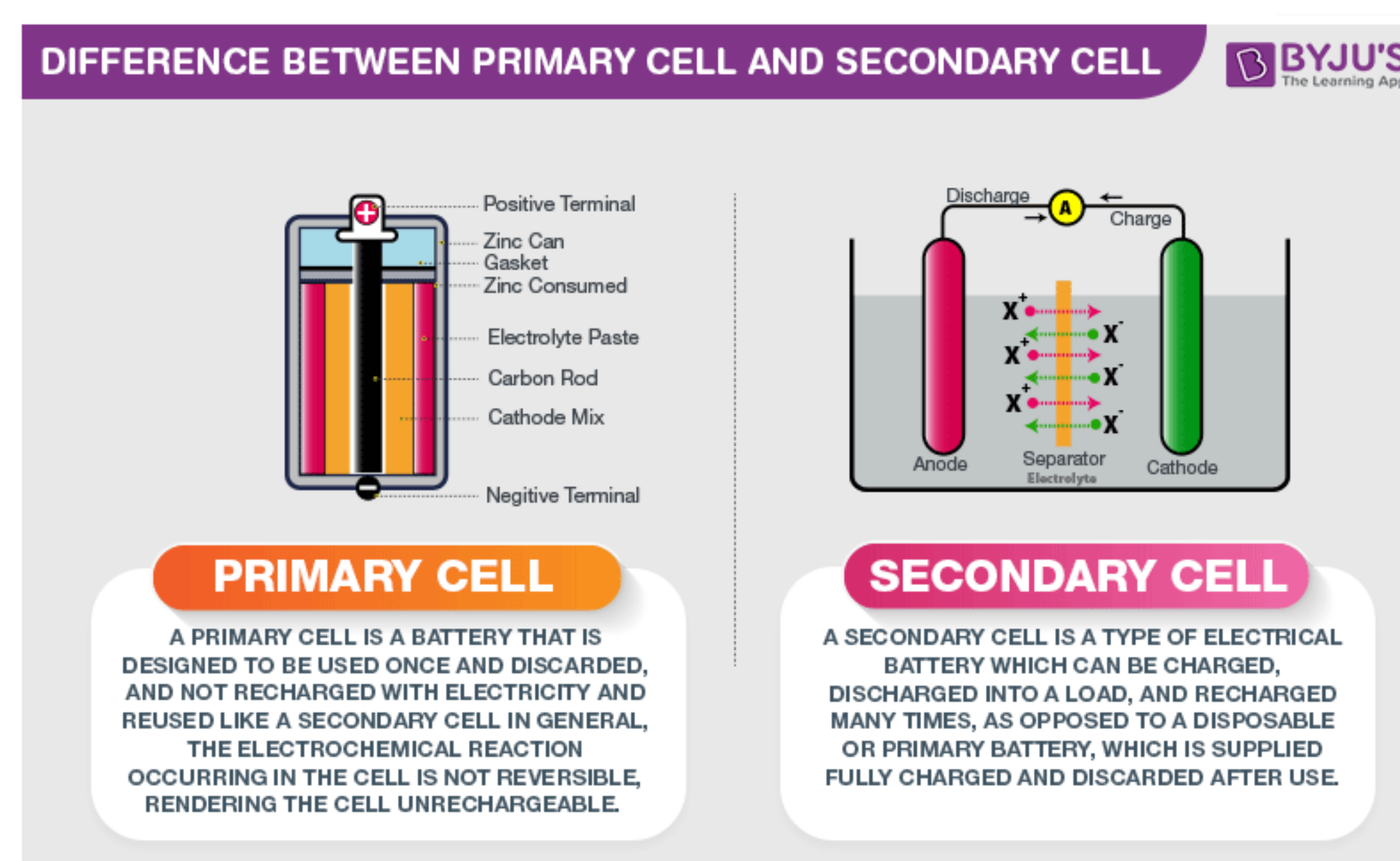
What's Better, Primary vs Secondary Batteries?

Courtney Catchpole, Daniel Pearson, and Ashley Siefker
Advisor: Dr. Erin Gibbemeyer

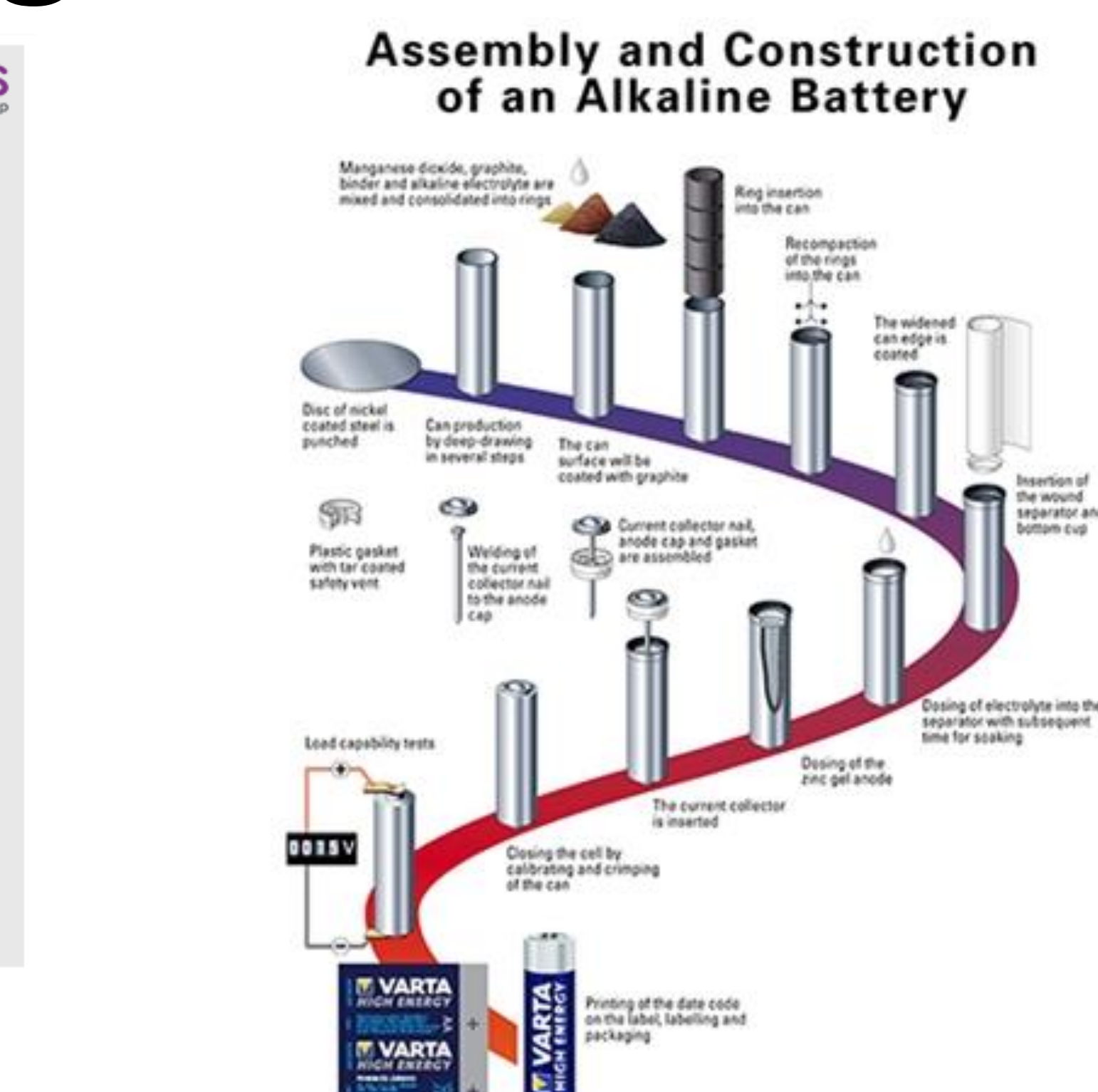
Abstract:

This project compares the manufacturing processes of primary and secondary batteries. Primary batteries are typical household batteries. Secondary batteries are rechargeable batteries and most commonly used for storage of electricity that is generated from renewable sources. This project explores the energy usage, greenhouse gas emissions, and other environmental impacts that result from the production of each type of battery.

Manufacturing Process:



Reference: "Difference Between Primary Cell and Secondary Cell." BYJU'S - The Learning App, byjus.com/chemistry/difference-between-primary-cell-and-secondary-cell/.



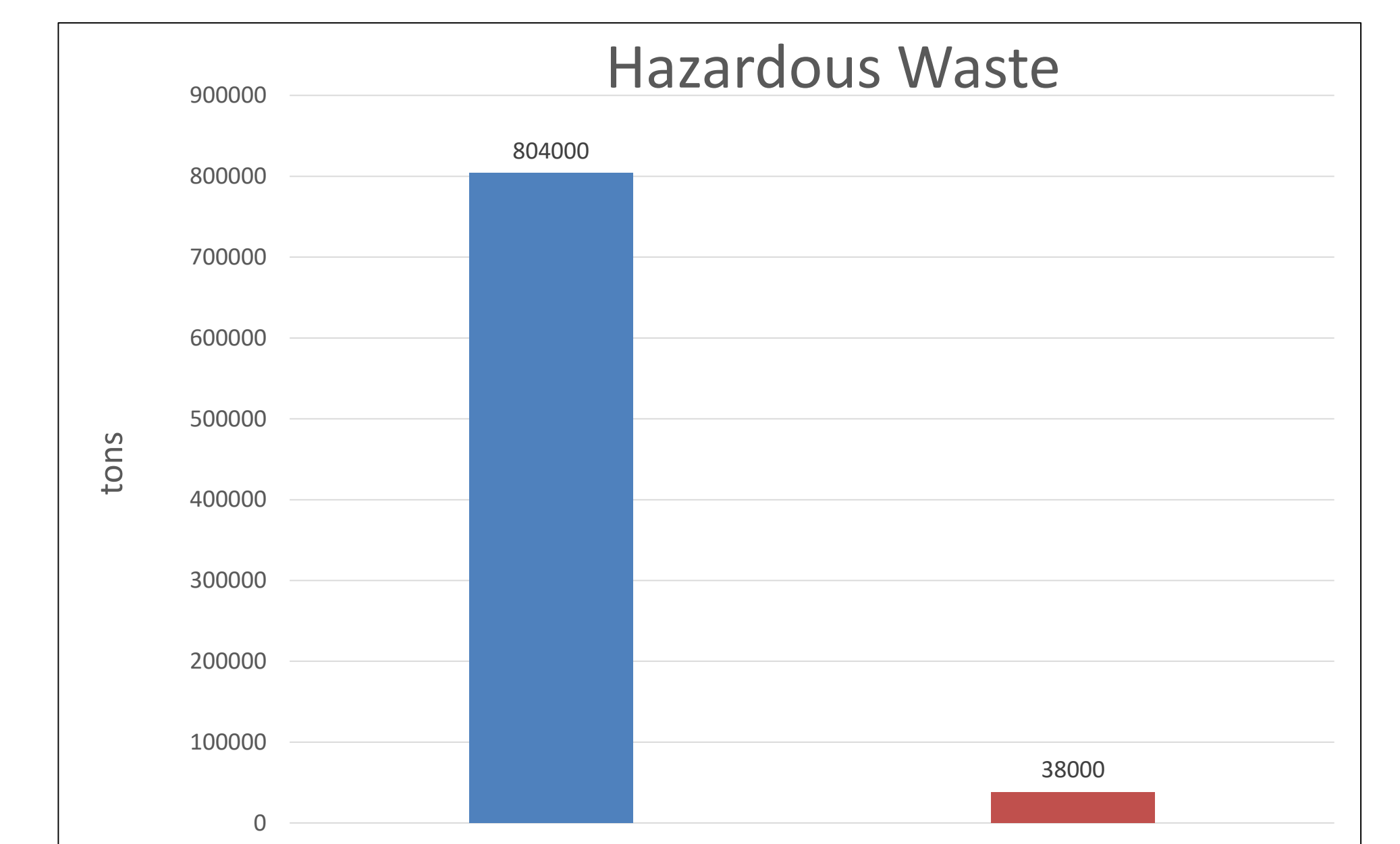
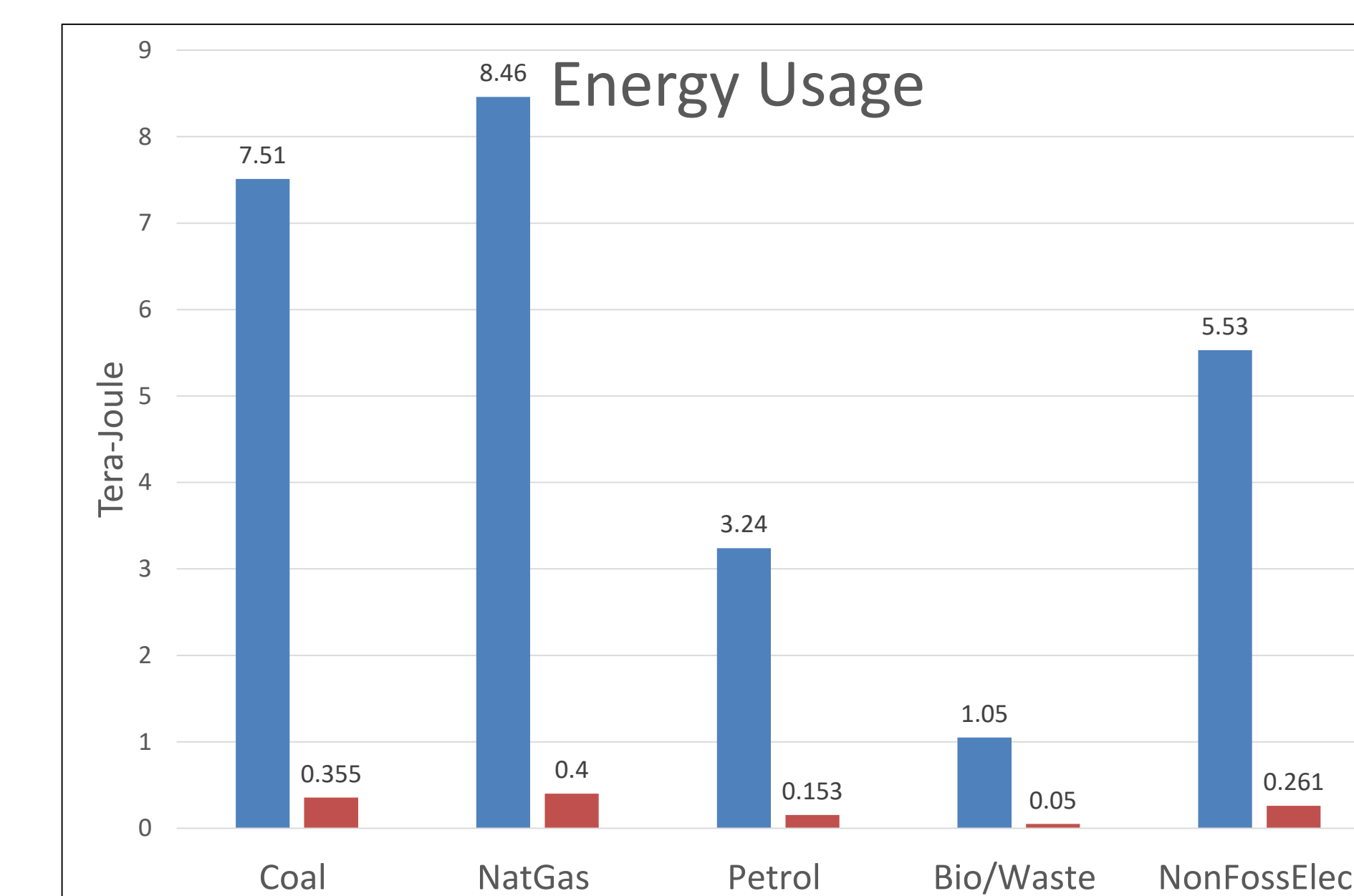
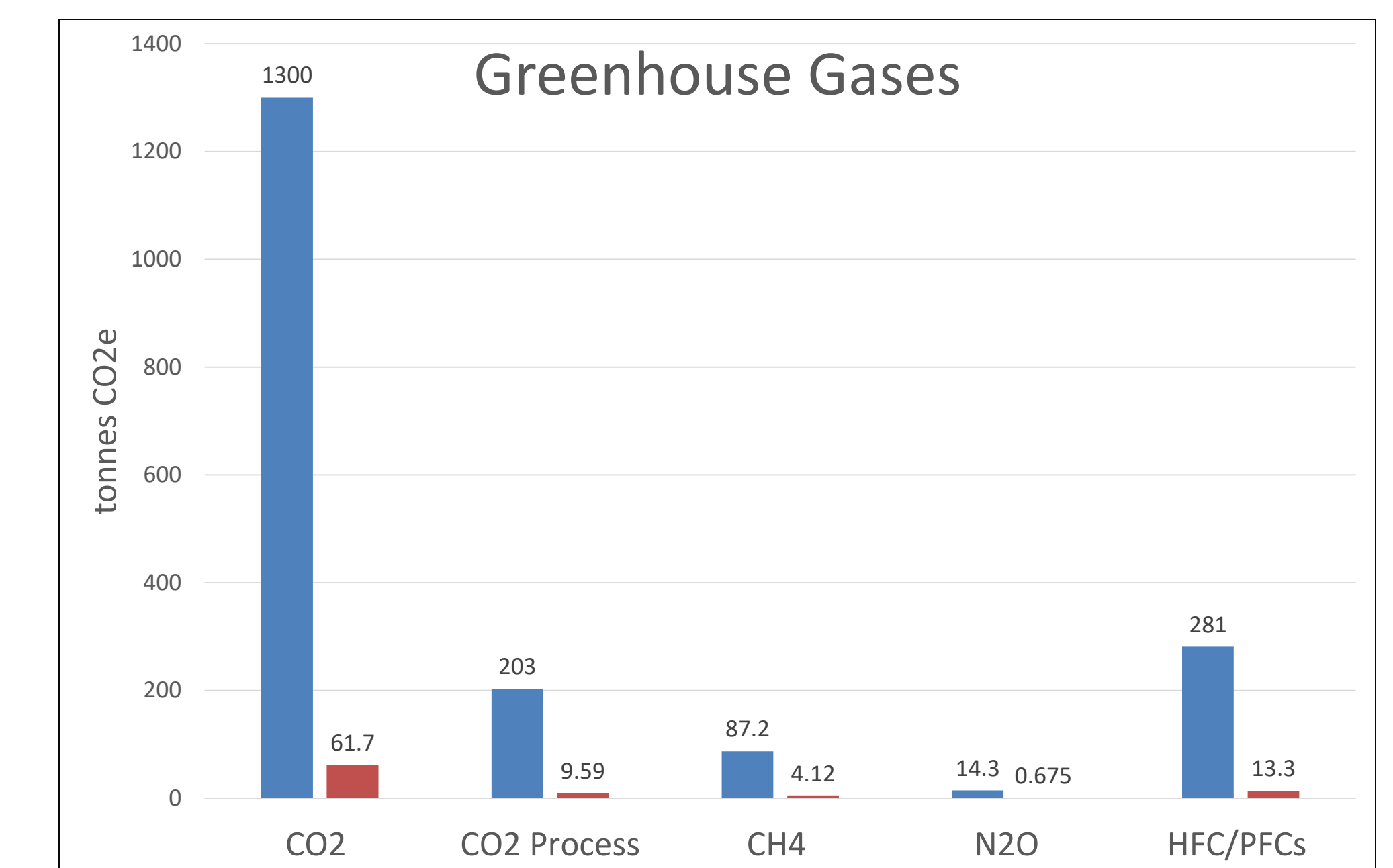
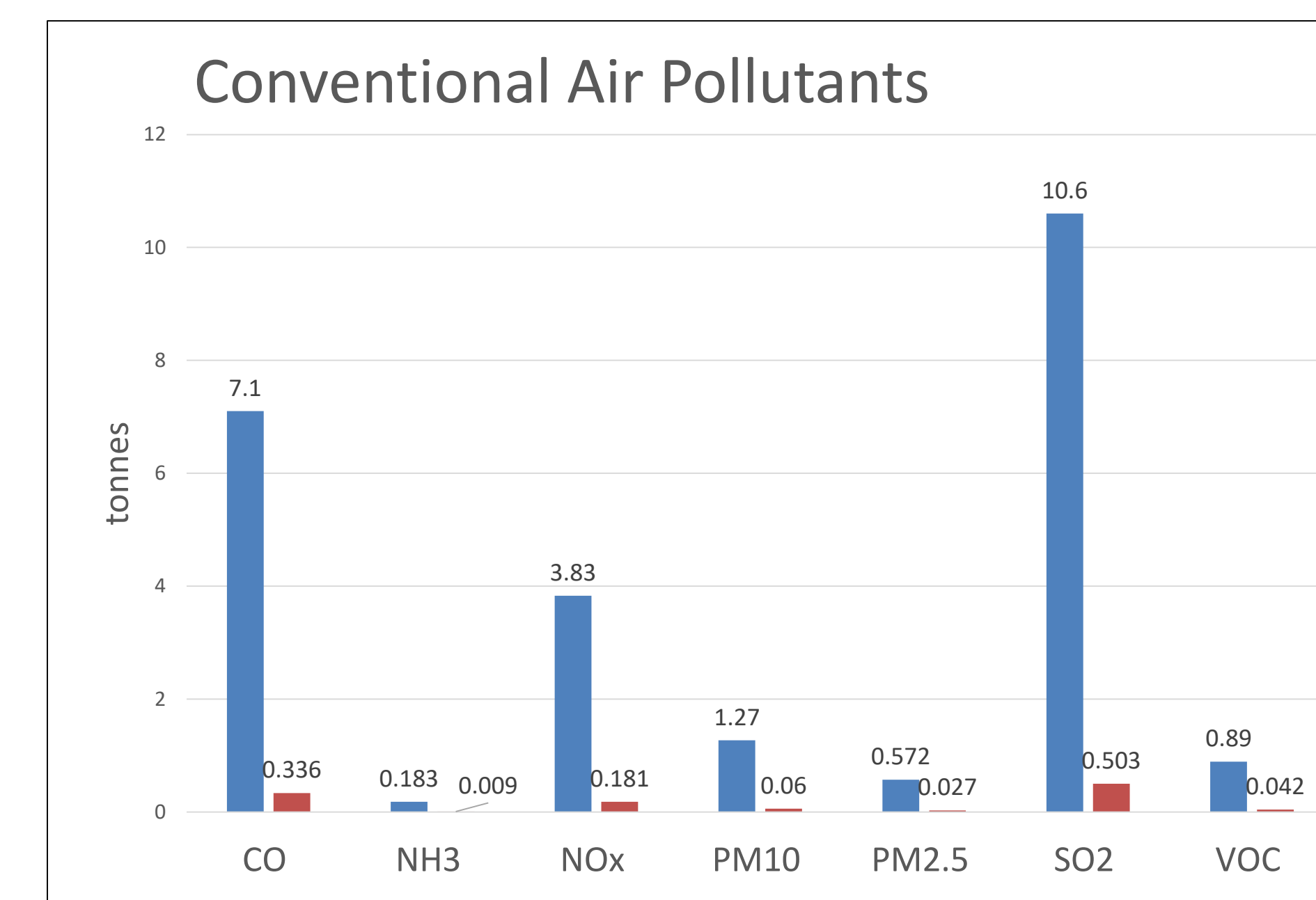
Reference: "How Are Batteries Made." VARTA Consumer Batteries, www.varta-consumer.com/en/insights/did-you-know/2015/how-are-batteries-made.

Methodology:

- Comparison based on a kilowatt hour produced
- Total Cost per kWh (includes fuel, maintenance, equipment, and recharging if applicable)
 - Primary Batteries: \$166/kWh
 - Secondary Batteries: \$7.85/kWh
- Used EIO-LCA model, economic input was cost to power a house for a year

Reference: "The Cost of Portable Power." The Cost of Portable Power Battery University, batteryuniversity.com/learn/archive/the_cost_of_portable_power.

Results:



Conclusions:

- Secondary battery manufacturing had significantly less damaging environmental effects when compared to the primary batteries.
- When compared on a battery to battery basis, secondary batteries produce more greenhouse gas emissions, use more energy, release more conventional air pollutants, and create more hazardous waste, but as few as eight recharges make secondary batteries more environmentally friendly
- Results align with previous EIO-LCA model studies on primary vs secondary batteries
- If batteries are recycled at the end of their life the environmental impacts from manufacturing could be lessened